BASSTEGG - Sketch Planning Charrette/GIS Models for Predicting Household Vehicle Miles of Travel (VMT) and Greenhouse Gas (CO_2) Emissions

Harold M. Brazil and Charles L. Purvis
Metropolitan Transportation Commission
TRB 2009 Transportation Planning, Land Use, and Air Quality Conference
July 29, 2009
Centennial, Colorado

1

Presentation Overview

- **Study Purpose**
- **Policy Context**
- **Past Data Supply Issues**
- **Model Development**
- **Detailed Results**
- **Conclusions/Next Steps**

Study Purpose 1

With the interest in the interactions of land use and transportation and their related impacts on global warming, there is now a warranted need for improved and quicker techniques for simulating mobile source based, regional and sub-regional greenhouse gas emissions.

Study Purpose 2

The Bay Area Simplified Simulation of Travel, Energy and Greenhouse Gases (BASSTEGG) is a GIS-based tool for calculating automobile availability, vehicle usage, fuel consumption, and greenhouse gas emissions, by each household within the San Francisco Bay Area at the neighborhood level.

Background: California's Major Climate Change Initiatives

- **Assembly Bill 1493 (Pavley, 2002),** *reduce greenhouse gas emissions released from new passenger cars, SUVs and pickup trucks sold in California starting in model year 2009*
- **2005 Governor Schwarzenegger's Executive Order S-3-05,** *sets targets to limit California's future greenhouse gas emissions*
- **Global Warming Solutions Act of 2006 (AB 32),** *sets enforceable state-wide program to cap greenhouse gas emissions and includes penalties for non-compliance*
- **Senate Bill 375 (Steinberg, 2008),** *regions will work to integrate development patterns and the transportation network in a way that achieves the reduction of greenhouse gas emissions while meeting housing needs and other regional planning objectives*

Local Community GHG Emission Requirements

- *Local governments in California are being asked to reduce GHG emissions 15% from current levels by 2020 (with an ultimate state-wide goal of 80% reductions by 2050)*
- *15% reduction from this level would actually constitute a 30% reduction by 2020*
  - *(as an example, a community's GHG emissions could continue to grow 20% plus over that time period if unchecked)*
- *Local governments have broad influence and, in some cases, exclusive authority over activities that contribute to significant direct and indirect greenhouse gas emissions through their planning and permitting processes, local ordinances, outreach and education efforts, and municipal operations*

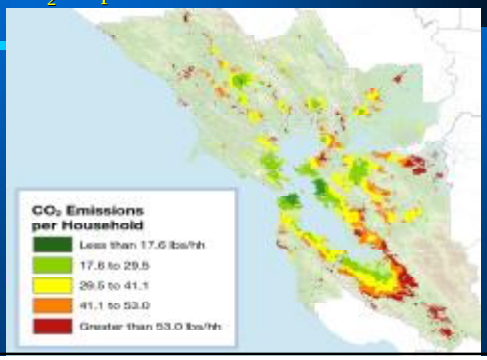
San Francisco Bay Area

- 9 Counties
- Over 7 million people; almost 4 million jobs
- 4.5 million cars and 4,300 transit vehicles
- 10.6% of households in rural area, 34% of households in urban area
- 14% zero-worker households, 10% zero-vehicle households
- 18.6% low income households, 24% high income households

Past Data Source for Local Community Level VMT (HPMS)

- *Worked with Sonoma County, Local Air District and ICLEI (International Council for Local Environmental Initiatives) now called "ICLEI-Local Governments for Sustainability" to develop mobile source GHG inventories for local communities in the region*
- *Used HPMS (Highway Performance Monitoring System) VMT data as Baseline*
- *Used Travel Demand Model Forecast VMT to "grow" Baseline HPMS VMT into future*
- *HPMS VMT is the VMT "Occurring In" the Community*
- ***Local Communities Need To Estimate The VMT That They Are Responsible For - Not "Passing Through" VMT***

Travel Demand Model Sourced Year 2006 CO_2 Map



Bay Area Simplified Simulation of Travel, Energy and Greenhouse Gases (BASSTEGG)

- *Can be used by local jurisdictions to independently calculate CO_2 and greenhouse gas emissions in an easy manner*
- *Three component models in the BASSTEGG:*
  1. *Models simulating auto ownership levels*
  2. *Models simulating vehicle usage levels*
  3. *Application of carbon dioxide emission factors (generated from ARB's EMFAC2007 model) to estimate CO_2 emission inventories*

BASSTEGG Dataset Components

- *MTC's existing auto ownership model produces zone level HHs by:*
  - *1) Income*
  - *2) Workers per HH*
  - *3) Vehicles per HH*

  Generates 36 Separate Market Segments
- *The Bay Area Travel Survey 2000 (BATS2000) collected household travel information for the region and disaggregate HH VMT by:*
  - *1) Income Group*
  - *2) Workers per HH*
  - *3) Vehicles per HH*
  - *4) Density Level*

  Generates 216 Total Household Groupings

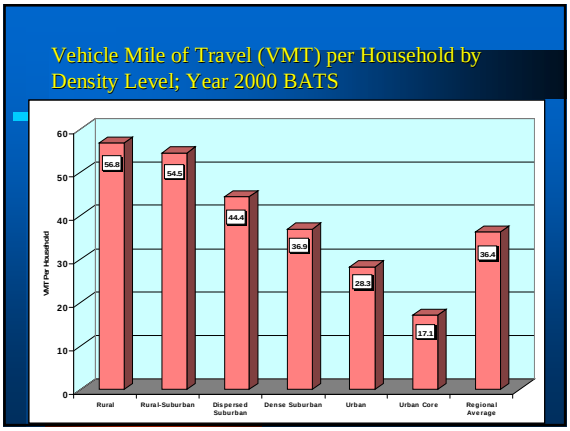
BASSTEGG Dataset Components

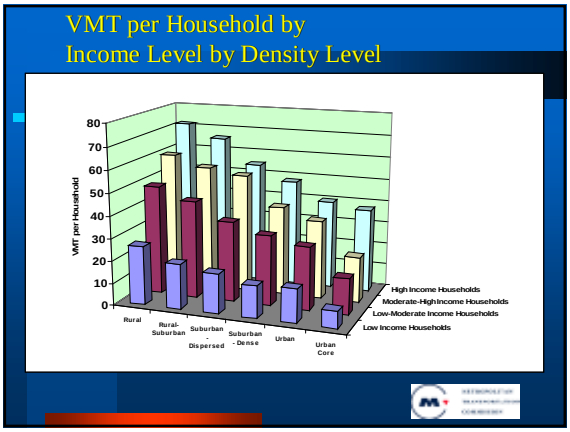
- *4 Income Group Categories*
- *3 Workers in Household Categories*
- *3 Vehicles Available in Household Categories*
- *6 Density Level Categories*

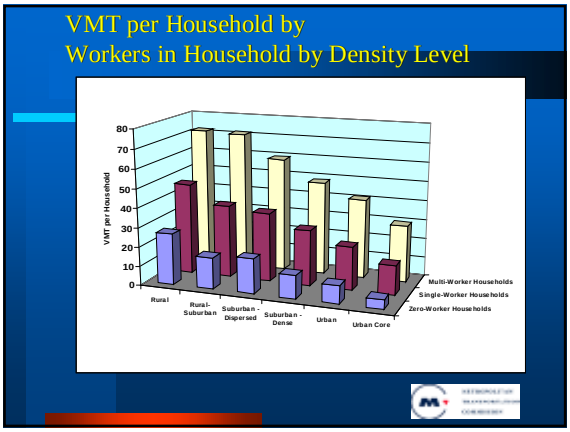
4 X 3 X 3 X 6 = 216 Total HH Groupings

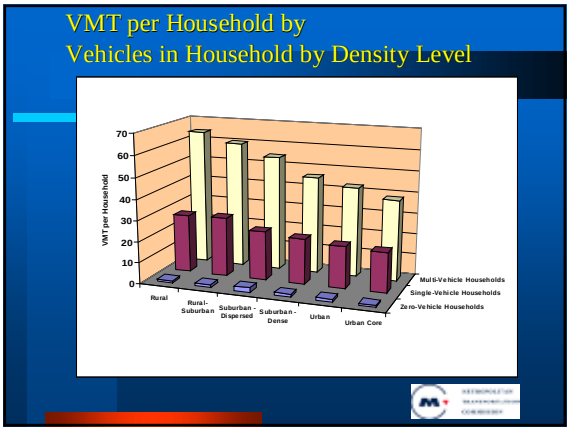
VMT per Household Cross Classification Model #1
VMT/HH rates by Income (4) by Density (6) by Workers in Household (3) by Vehicles Available in Household (3) (216)

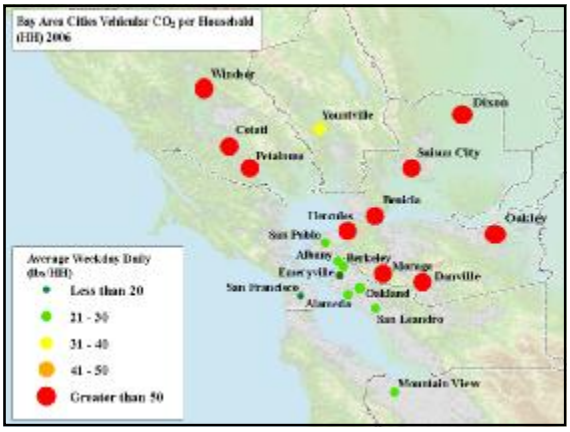
Income Level	Density Level	WHH=0 VHH=0	WHH=0 VHH=1	WHH=0 VHH=2+	WHH=1 VHH=0	WHH=1 VHH=1	WHH=1 VHH=2+	WHH=2+ VHH=0	WHH=2+ VHH=1	WHH=2+ VHH=2+
	Rural	0.41	17.77	22.88	1.49	28.14	32.12	2.00	16.60	60.46
	Rural-Suburban	0.41	13.22	22.88	1.49	28.14	32.12	2.00	16.60	55.61
Low	Suburban - Dispersed	0.41	12.99	24.83	1.49	19.24	32.12	2.00	16.60	48.77
Income	Suburban - Dense	0.41	10.54	24.83	1.49	18.93	32.12	2.00	14.93	47.36
Households	Urban	0.41	10.54	12.36	1.49	17.13	32.12	2.00	14.93	36.27
	Urban Core	0.41	8.10	12.36	1.49	16.01	23.42	2.00	11.53	33.64
	Rural	0.41	21.35	38.45	1.49	38.17	57.34	2.00	30.19	64.69
Moderate-	Rural-Suburban	0.41	21.35	32.60	1.49	35.21	47.92	2.00	30.19	62.73
Low	Suburban - Dispersed	0.41	18.23	26.20	1.49	27.58	46.65	2.00	30.19	47.20
Income	Suburban - Dense	0.41	16.10	22.37	1.49	25.17	36.35	2.00	30.19	47.20
Households	Urban	0.41	8.32	22.37	1.49	24.70	36.35	2.00	23.73	43.17
	Urban Core	0.41	8.32	12.08	1.49	20.05	24.45	2.00	23.30	32.23
	Rural	0.41	15.84	36.89	1.49	30.16	56.00	2.00	31.36	73.00
Moderate-	Rural-Suburban	0.41	15.84	31.18	1.49	30.16	46.82	2.00	31.36	71.40
High	Suburban - Dispersed	0.41	15.84	29.08	1.49	26.85	46.82	2.00	31.36	68.85
Income	Suburban - Dense	0.41	15.84	28.55	1.49	26.85	36.86	2.00	25.55	52.95
Households	Urban	0.41	10.29	26.85	1.49	23.61	32.83	2.00	20.13	48.62
	Urban Core	0.41	10.29	17.44	1.49	19.77	32.32	2.00	16.90	37.97
	Rural	0.41	13.02	28.16	1.49	24.94	60.16	2.00	27.93	80.07
	Rural-Suburban	0.41	13.02	28.16	1.49	24.94	60.16	2.00	27.93	78.75
High	Suburban - Dispersed	0.41	13.02	28.16	1.49	24.94	46.47	2.00	27.93	63.52
Income	Suburban - Dense	0.41	13.02	28.16	1.49	24.94	45.78	2.00	27.93	55.45
Households	Urban	0.41	13.02	28.16	1.49	24.94	32.90	2.00	27.93	52.75
	Urban Core	0.41	13.02	28.16	1.49	24.94	32.90	2.00	27.93	52.75

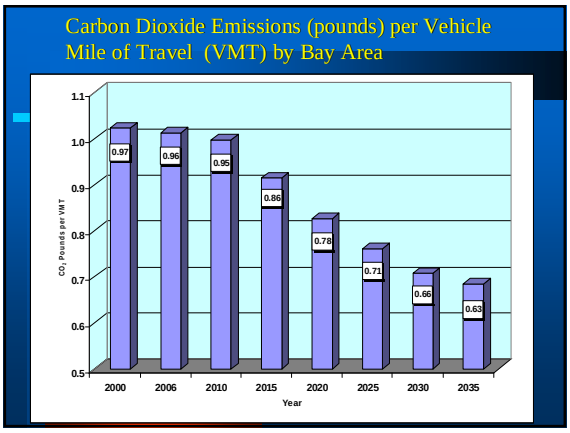


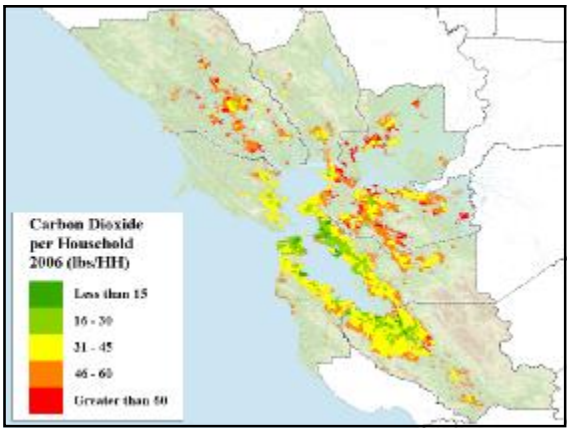


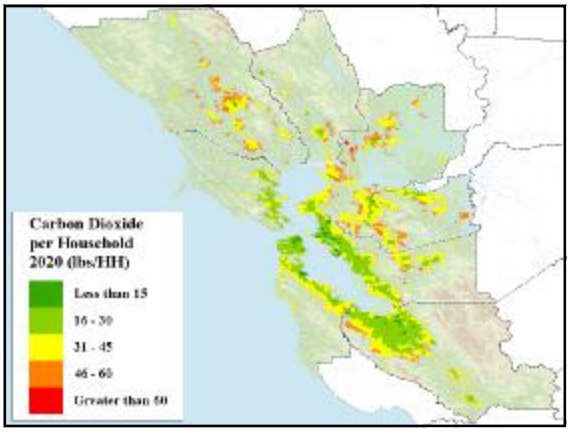


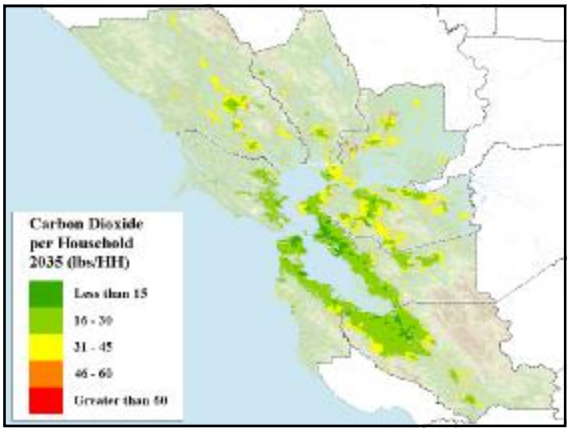












Conclusions

- Bay Area local community planners estimate household VMT-based CO_2, greenhouse gas emission inventories and alter current socio-economic and land use conditions to calculate potential emission benefits and/or impacts.
  - Planners can complete these estimates independently with a minimal level of effort
- Limitation: With BASSTEGG, CO_2 emission estimates are household based only. Emissions due to commercial vehicle travel, municipal vehicle travel and inter-regional travel are not accounted for in this model.
  - Future improvements to BASSTEGG would be directed at including other non-household based travel in its CO_2 emission inventory estimates

Additional Information

- **Speaker Contact:**
  Harold Brazil, Air Quality Planner/Analyst
  Metropolitan Transportation Commission
  (510) 817-5747; hbrazil@mtc.ca.gov
  Chuck Purvis, Principal Transportation Planner/Analyst
  Metropolitan Transportation Commission
  (510) 817-5755; cpurvis@mtc.ca.gov
- **BASSTEGG FTP Site:**
  ftp://ftp.abag.ca.gov/pub/mtc/planning/forecast/BASSTEGG/
  http://www.mtc.ca.gov > Maps and Data > Research